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School of Advanced Sciences (SAS)

Introduction to Innovative Projects- PHY1999

Project Review 3

Topic: Smart Street Lights using Ultrasonic Sensors and Voice Controlled Lights using NodeMCU

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Introduction to Innovative Projects

Project Review -3

Smart Street Lights using Ultrasonic Sensors and Voice Controlled
Lights using NodeMCU

OBJECTIVE

In this project we will try to implement two innovative methods to reduce electricity consumption:

- Smart Street Lights using Ultrasonic Sensors
- Voice Controlled Lights using NodeMCU **Keywords:**

Ultrasonic Sensors

NodeMCU

Adafruit Arduino

Uno

ABSTRACT

1. Smart Street Lights using Ultrasonic Sensors

This is an implementation of a working model which will be able to detect motion and switch on the LEDS accordingly .The technology has emerged as an innovative smart city application with great potential to reduce energy cost and enhance public safety. The system demonstrates the benefits of two smart city applications for public safety enhancement, while revealing multiple cyber-security challenges.

2. Voice Controlled Lights using NodeMCU

Google assistant is AI (Artificial Intelligence) based voice command service. Using voice, we can interact with google assistant and it can search on the internet, schedule events, set alarms, control appliances, etc.

This service is available on smartphones and Google Home devices.

We can control smart home devices including lights, switches, fans and thermostats using our Google Assistant.

We will build an application which can control home appliances. Here, we will control a 60W bulb using Google Assistant service **just by our voice**.

This application includes Google assistant along with Adafruit server and IFTTT service.

SOFTWARE AND COMPONENTS

1. Smart Street Lights using Ultrasonic Sensors

Hardware Components:

Ultrasound sensors-2

Resistors

Breadboard

Arduino Uno

Jumpers

LEDs-3

Software Used:

Arduino IDE

2. Voice Controlled Lights using NodeMCU

Hardware Components:

LED

Jumpers

Resistors

BreadBoard

Arduino Uno

Software Used:

Node MCU

IFTTT

Google Assistant

Adafruit

Motive

The purpose behind doing this project is to find solutions towards saving electricity, and using it only as much as is required, without unnecessarily wasting it, hence, we have created the smart street lights using ultrasound sensors. It is an optimal low cost alternative to turn on the street lights on the roads only when a car is present, switching them off otherwise. As electricity is saved, more street lights can be installed for the same price to run on the same amount of electricity. The cameras and speed calculators in them also provide coverage of areas that are dangerous.

As the world is entering the era of automation, with minor changes to devices that we use in our daily lives, it becomes easier to operate them, and saves time and energy. Our voice based light control system provides a smart solution by making a small change in the existing household circuitry. It allows users to be able to control multiple devices, using an application that they can speak commands to, even if they are not physically present near the device. This will help us save electricity by giving a choice to turn off far away devices, when we do not have the time to manually go and switch them off. Moreover, if many appliances can communicate with each other through WiFi, they can turn on or off by detecting the presence of the user out of the first room, and into the second room etc. This idea can also be deployed to large cities to manage buildings altogether.

Advantages

- Low cost solution
- Easy installation
- Saves electricity
- More units running on same amount of electricity
- Widespread camera coverage of dangerous roads at night

- Speed checking meters can be installed, as presence of car is detected
- Less time and energy required to operate devices
- Minor changes in circuitry involved
- Communication between devices possible through WiFi
- More automated approach towards daily routines

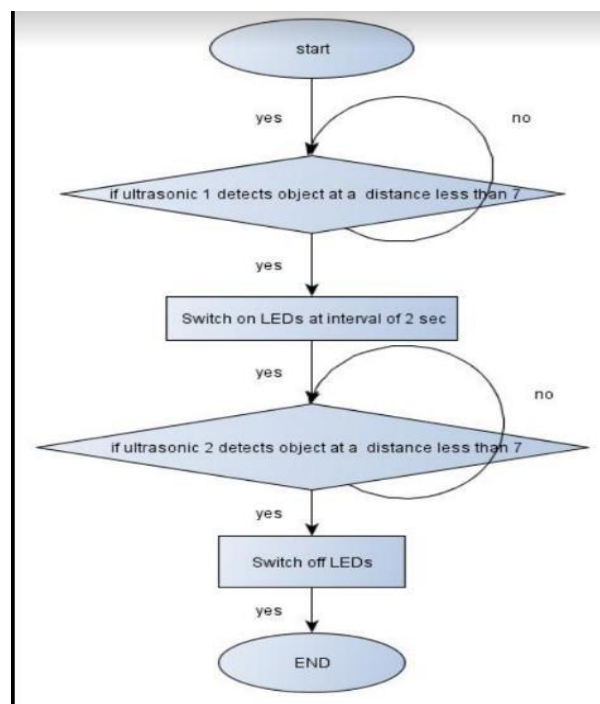
Disadvantages

As we are evolving, people are becoming more lazy, wasting more resources and trying to make their lives simpler while the environment is taking a toll. Our demands are ever increasing, but we do not contribute equally to creation of the resources required for that. Newer technologies attract people, without focusing on its environmental impact thus influencing the society as well. This also generates an increasing amount of waste such as factory residues, gases, toxic substances and pollution. Electronic waste is also a new addition to this today, as every 2 years, people buy new phones and upgrade their appliances. The overall picture is quite shocking, and we wonder whether new innovations are actually required as they are doing us more harm than good. The term innovation today, in our opinion is a misleading concept, as it just means that something has been created to make our lives easier, or a new idea has been thought of, without involving the equivalent environment impact. This term must be modified to take this into consideration too, as an innovation that hurts the environment is at the end of the day harming us and not an innovation per say. We must look for solutions that are eco-friendly as they are actual innovations, that can be used for a long time, and are sustainable too. The awareness for good, environmentally sound innovations, must be spread in societies, so that more people realize it and act accordingly, as responsible individuals. The solutions that we have proposed take this into consideration with no additional waste generation or harmful impact on the environment.

PROPOSED MODEL

1. Smart Street Lights using Ultrasonic Sensors

Our model is a conventional method of reducing power consumption in street lights, which are one of the major power consuming public resource. In our model we aim to implement the use of Arduino board. Which is going to handle the control system of all street lights. We are going to connect this board with passive infrared sensors, which are going to detect movement on the road. We will detect the movement using this sensor in the first streetlight present in the street, which will inform all other street lights , therefore all the other streetlights will be triggered and turned on 2secs after one another. It will remain switched ON until the last street light in the street if the sensors will detect any movement, which will show that the traveler has passed through this street. We will have two ultrasonic sensors implemented on each street, this way we can save energy .



In this working model , We have used Arduino UNO, which has been interfaced with 2 ultrasonic sensors, which we have connect trigger(1) with 5 of digital pin in Arduino board. In the same way, we connect all the other pins of our sensors to the board which will take values from the pins and provide the required information to the board. The trigger pin is set as low, and then for a while set a high, if an object is present in front of the sensor, the ultrasonic waves will get reflected back to the echo pin, which will be high for a while, the duration in which the wave returns back to the sensor, is then converted into distance, which gives us our required value.

After Connecting the major component, which is the ultrasonic sensors, we then connect few LEDs which are working as our street lights, therefore in the code for this program, we will first take values from ultrasonic sensor (1) which is located in the start of the road, then we calculate the distance using $d=t*s$, which will give us the closeness of that object to the first sensor, here we set if the value of distance is less than 7, then the object has entered the road, then we will switch on the led's with a little duration. And finally when the object is detected by the second ultrasonic sensor, the lights will turn off. By this mechanism, we can monitor the number of vehicles entering a road, and conserve electricity.

2. Voice Controlled Lights using NodeMCU

The following steps are followed in the implementation:

i) Create an account using Adafruit at www.Adafruit.com ii) Now, create dashboard at Adafruit. This dashboard is a user interface to control things remotely.

iii) After following above steps, provide name to the dashboard and save it iv)

Now, create feed (user interface) to control light On-Off. To create it, just click on '+' symbol and select toggle feed

v) After selecting toggle feed, pop-up window appears vi) Enter name of our feed (shown in red box) and create it. After creation, select the created feed (here ours is light) and click on next step vii) In the next step configure the feed. Here, we used **0**(OFF) and **1**(ON) text for button and then click on create. This will create toggle button on your dashboard which

can be used to control things remotely. viii) Now, my dashboard is ready for IoT application like home automation.

IFTTT (If This Then That)

If This Then That, also known as IFTTT is a free web-based service to create chains of simple conditional statements, called applets. An applet is triggered by changes that occur within other web services such as Gmail, Facebook, Telegram, Instagram, or Pinterest.

For example, an applet may send an e-mail message if the user tweets using a hashtag or copy a photo on Facebook to a user's archive if someone tags a user in a photo.

Here, I used IFTTT to use google assistant service and Adafruit service in chain. So, when I use google assistant to control light of my home by saying Ok google, turn the light ON or OFF. Then IFTTT interpret the message and can send it to Adafruit's dashboard as a understandable command to the created feed.

The IFTTT is configured through the following steps:

i) First step is creating account on IFTTT.

Note: Create account on IFTTT by using same e-mail id which you have used for Adafruit.

ii) After account creation, click on **My Applets** and then select **New Applet** iii) After selecting a new applet, we get a new page in which we should click on to **This** iv) Then search for **Google Assistant** and select it

v) Now, enter voice phrases which we will use as a command for google assistant.

What do you want to say?

turn Light ON

What's another way to say it? (optional)

turn ON Light

And another way? (optional)

Light ON

What do you want the Assistant to say in response?

turning ON Light

Language

English

vi) We can enter any phrase as per our application. As you can see, the phrases entered in the above fields are for making **Light ON**. For making **Light OFF**, we have to create another applet with different phrases.

vii) Now, we get another page on which we have to click on **that** option which is used to connect Google Assistant with Adafruit. ix) Then search for **Adafruit** and select it.

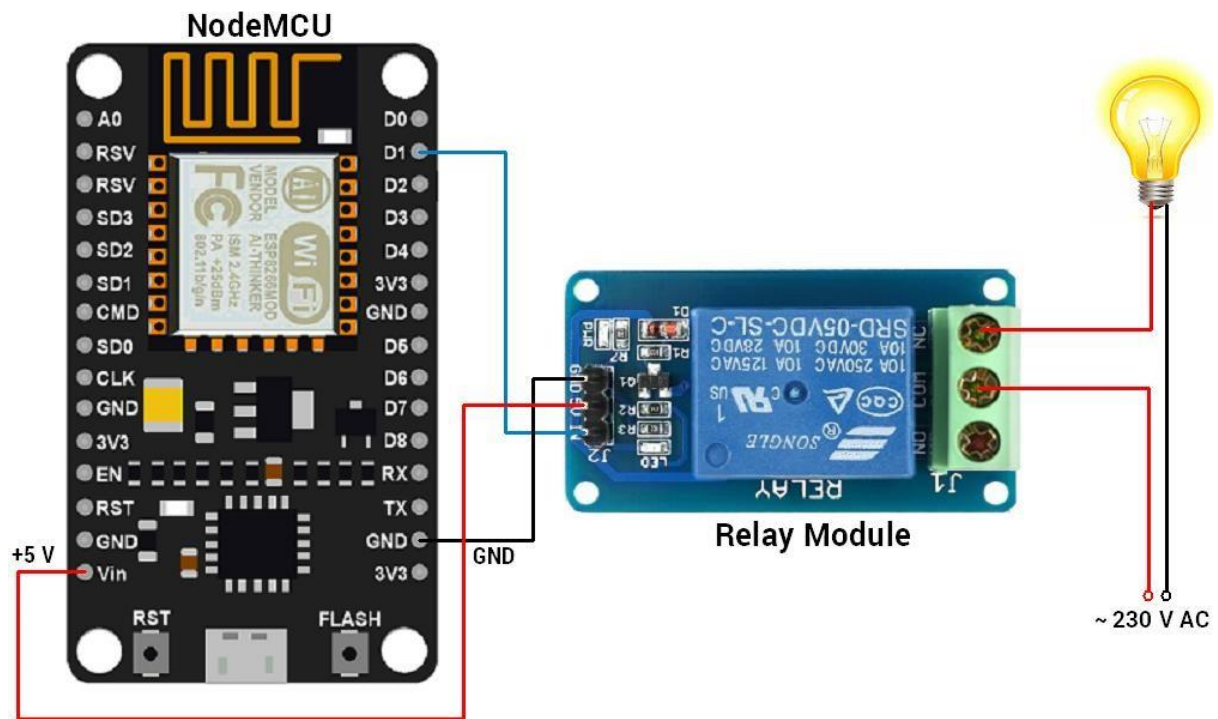
x) After selecting Adafruit, choose action which will send a feed to your Adafruit IO

xi) Now enter what data we need to send to which feed of Adafruit dashboard.

xii) Click on **Create Action**.

So, when I use Google Assistant on my mobile and give voice command as "Ok Google, Turn LED ON", applet created in IFTTT receives this command and will send data '1' to the Adafruit feed. This will trigger the event on Adafruit dashboard which is continuously monitored by the microcontroller (here NodeMCU). This microcontroller will take action as per the data change on the Adafruit dashboard.

Interfacing Diagram:



Libraries used:

Here, we used the Adafruit MQTT library for receiving data from the Adafruit server. To install this library, select option **Sketch -> Include Library -> Manage Libraries**.

In that library, search for Adafruit MQTT and installed it.

Control Home's Light using Google Assistant and NodeMCU

We built an IoT based application in which we control the LED remotely using AI based Google Assistant.

Here, we used NodeMCU to read data from Adafruit server and act accordingly. LED connected to NodeMCU via relay for controlling it voice command using google assistant.

Arduino IDE Interface Code:

```
#define trigPin1 6
#define echoPin1 5
#define trigPin2 10
```

```
#define echoPin2 9
```

```
long duration, distance1,distance2, RightSensor,BackSensor,FrontSensor,LeftSensor;
```

```
void setup()
```

```
{
```

```
  Serial.begin      (9600);
```

```
  pinMode(trigPin1, OUTPUT);
```

```
  pinMode(echoPin1, INPUT);
```

```
  pinMode(trigPin2, OUTPUT);
```

```
  pinMode(echoPin2, INPUT);
```

```
}
```

```
void loop() {
```

```
  SonarSensor(trigPin1, echoPin1);
```

```
  RightSensor = distance1;
```

```
  if(distance1<10)
```

```
  {
```

```
    digitalWrite(7,HIGH);
```

```
    delay(10);
```

```
    digitalWrite(4,HIGH);
```

```
    delay(10);
```

```
    digitalWrite(3,HIGH);
```

```
  }
```

```
  SonarSensor(trigPin2, echoPin2);
```

```
  LeftSensor = distance1;
```

```
  if(distance1<10)
```

```
  {
```

```
    digitalWrite(7,LOW);  
    delay(10); digitalWrite(4,LOW);  
    delay(10); digitalWrite(3,LOW);  
}  
Serial.print(LeftSensor);  
Serial.print(" - ");  
Serial.println(RightSensor);  
  
}
```

```
void SonarSensor(int trigPin,int echoPin)  
{  
    digitalWrite(trigPin, LOW);  
    delayMicroseconds(2);  
    digitalWrite(trigPin, HIGH);  
    delayMicroseconds(10);  
    digitalWrite(trigPin, LOW); duration  
    = pulseIn(echoPin, HIGH);  
    distance1 = (duration/2) / 29.1;  
  
}
```

SUMMARY AND RESULTS

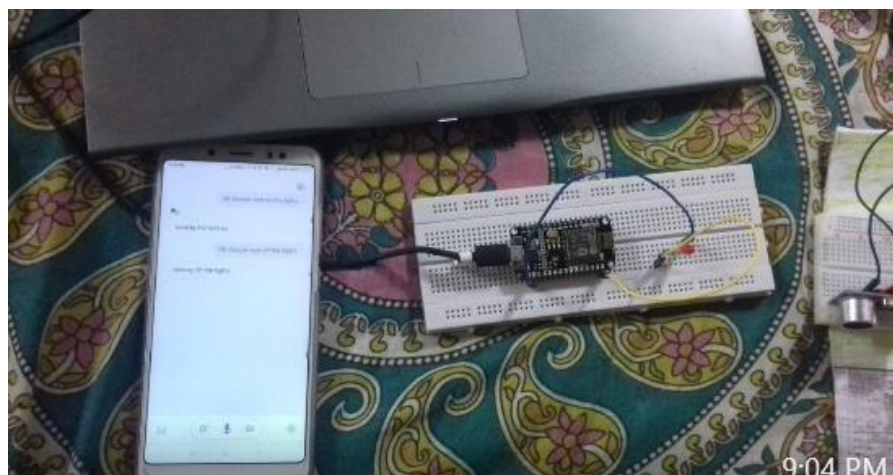
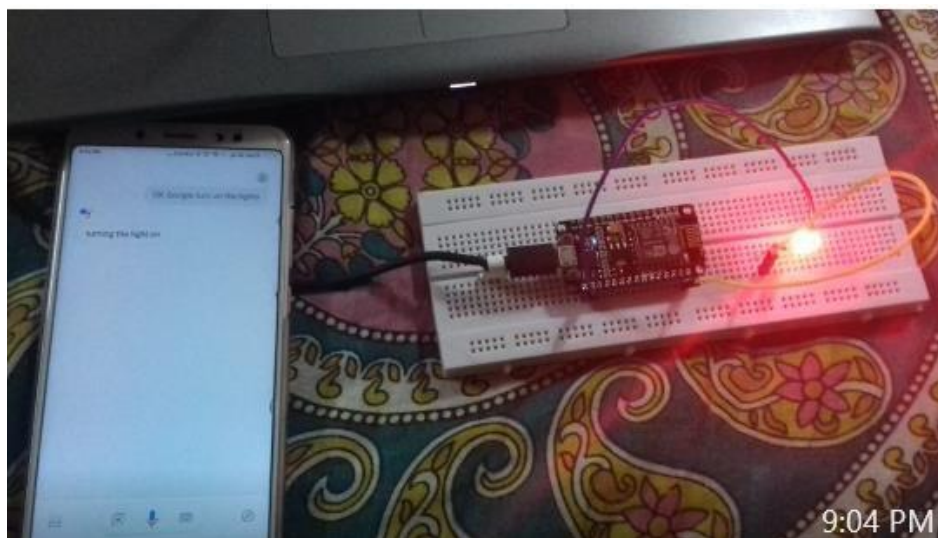
1. Smart Street Lights using Ultrasonic Sensors

Currently, in the whole world, enormous electric energy is consumed by the street lights, which are automatically turn on when it becomes dark and automatically turn off when it becomes bright. This is the huge waste of energy in the whole world and should be changed. The main aim of the proposed model is that lights turn on when needed and light turn off when not needed. Moreover, this system behaves like usual street lights that turn on all night, and can also be used to calculate the amount of traffic at any point of time. The project is designed for LED based street lights. A number of LED streetlights glow for a specific distance ahead, on sensing an approaching vehicle and then switches OFF once the vehicle passes by. Thus a lot of energy is saved in this process. Optionally, dimming feature can be used in this system while no vehicles are passing on the road.



2. Voice Controlled Lights using NodeMCU

Today, the world is slowly being overtaken by the amazing technology of IOT, where remote devices can be controlled merely by a voice command, or by the click of a button provided that the area has a good WiFi connection. In the same way, appliances in homes can also be connected accordingly using the technology of Google assistant. This may be deployed to larger areas such as the recent smart street and smart city concepts and serves as an energy efficient, environment-friendly and cost-effective solution that can be used to control and communicate with multiple devices at the same time.



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3. Automatic Streetlights that Glow on Detecting Night and Object using Arduino Zain Mumtaz¹ , Saleem Ullah¹ , Zeeshan Ilyas¹ , Shuo Liu² , Naila Aslam¹ , Jehangir ArshadMeo³ , Hamza Ahmad Madni^{2, 4*}
4. Smart street light system looking like usual street lights based on sensor networks
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